

CITIZEN

Specifications

CONTROL BOARD FOR MLT-289

MODEL BD2-2890DD

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Japan CBM Corporation

REVISION

| Rev. No. | Date | Content |
|----------|------------|--|
| 1.00 | 2003.03.18 | First created. |
| 1.01 | 2003.06.27 | Factory setting of jumper J1-2 is changed. |
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CONTENTS

| | |
|---|-----------|
| 1. OUTLINE | 1 |
| 1.1 Features | 1 |
| 1.2 Precaution | 1 |
| 2. BASIC SPECIFICATIONS | 2 |
| 3. CONNECTING CONNECTORS..... | 3 |
| 3.1 CN1 Connector for Printer Mechanism (For Print Head) | 3 |
| 3.2 CN2 Connector for Print Mechanism (For Motor & Sensor)..... | 3 |
| 3.3 CN3 Connector for Interface | 4 |
| 4. JUMPER SETTING | 6 |
| 5. POWER SUPPLY | 8 |
| 5.1 Specifications | 8 |
| 5.2 Precautions | 8 |
| 6. SERIAL INTERFACE | 9 |
| 6.1 Specifications | 9 |
| 6.2 Explanation of Input/Output Signals | 10 |
| 6.3 Error Detection | 10 |
| 6.4 Data Receiving Control | 10 |
| 6.5 Buffering..... | 11 |
| 6.6 Electrical Characteristics | 11 |
| 7. ERROR HANDLING | 12 |
| 7.1 Peripheral Circuit Errors | 12 |
| 7.2 Operation Errors | 13 |
| 8. PRINTER MECHANISM CONTROL SYSTEM | 14 |
| 8.1 Thermal Head Control System (Division Driving System)..... | 14 |
| 8.1.1 Fixed Division Number System | 14 |
| 8.1.2 Variable Division Number System | 14 |
| 8.2 Motor Drive | 15 |
| 8.2.1 Motor Drive Features | 15 |
| 8.2.2 Maximum Motor Drive Speeds at Major Voltage | 15 |

| | |
|--|-----------|
| 9. PRINT CONTROL FUNCTIONS | 16 |
| 9.1 Command List | 16 |
| 9.2 Command Details | 18 |
| 9.2.1 Description of Items | 18 |
| 10. CHARACTER CODE TABLE | 63 |
| 10.1 International | 63 |
| 10.2 Japanese | 64 |
| 10.3 International Character Set | 65 |
| APPENDIX 1. BLOCK DIAGRAM | 66 |
| APPENDIX 2. OUTER DIMENSION | 67 |

1. OUTLINE

This control boards is designed to be used to control our thermal printer, “MLT-289” series through the computer etc.

As being provided with many abundant functions, it can be used widely in various applications. Before you start using it, read this manual thoroughly and understand the content.

1.1 Features

- (1) Ultra compact
- (2) Input buffer incorporated.
- (3) Bar code printing is available (dedicated command).
- (4) User-defined character registration function (94 characters)

1.2 Precaution

- (1) Make sure to turn OFF the power supply in case of connecting/disconnecting the connectors.
- (2) Absolutely do not make a short circuit between the terminals of connectors.
- (3) Use power supply, interface etc. following their specifications.
- (4) Use the recommended paper shown below.
 - Thermal Paper TF5KS-E2D (Nippon paper)
KF50-HDA (Shin-Oji paper)
F220VP, HP220A (Mitsubishi paper)

2. BASIC SPECIFICATIONS

| Items | Contents |
|-----------------------|---|
| Printing system | Thermosensitive dot-matrix printing |
| Print width | 48 mm |
| Print Speed | 420 dot line/sec |
| Number of columns | Font A : 32 columns |
| | Font B : 42 columns |
| Character dimensions | Font A : 1.25 mm × 3.00 mm |
| | Font B : 0.88 mm × 3.00 mm |
| Character types | Alphanumeric, international characters |
| Bar code type | UPC-A/E, JAN (EAN) 13/8 columns, ITF CODE 39, CODE128, CODABAR |
| Line pitch | 4.23 mm (Can be changed by command) |
| Interface | Serial (Conforms to RS-232C) |
| Input buffer | 2 K bytes |
| Supply voltage | VCC: 5V ± 5 % Approx. 130 mA (Self printing) VP : 4.2V ~ 8.5V Approx. 1.5A (Ave) Approx. 4A (Peak) When 7.2V Ordinal voltage is to be 7.2V (Max) 8.5V is a voltage, which is right after charging. |
| Weight | Approx. 35 g |
| Outer Dimension | 50 mm (W) × 75 mm (D) (See outer drawing for details) |
| Operating Environment | 5 ~ 40°C , 35 ~ 85% RH (with no dew condensation) |
| Storage Environment | -20 ~ 60°C , 10 ~ 90% RH (with no dew condensation) |

3. CONNECTING CONNECTORS

3.1 CN1 Connector for Printer Mechanism (For Print Head)

| Pin No. | Signal Name | I/O | Function |
|---------|-------------|--------|---------------------------------|
| 1 | VH | – | Power for print head |
| 2 | VH | – | Power for print head |
| 3 | SI | Output | Head data output signal |
| 4 | GND | – | GND |
| 5 | TM | Input | Thermistor |
| 6 | STRB 1 | Output | Strobe 1 |
| 7 | STRB 2 | Output | Strobe 2 |
| 8 | Vdd | – | Thermal head logics power (+5V) |
| 9 | LATCH | Output | Latch signal |
| 10 | GND | – | GND |
| 11 | STRB 6 | Output | Strobe 6 |
| 12 | CP | Output | Clock pulse |
| 13 | GND | – | GND |
| 14 | STRB 5 | Output | Strobe 5 |
| 15 | STRB 3 | Output | Strobe 3 |
| 16 | GND | – | GND |
| 17 | GND | – | GND |
| 18 | STRB 4 | Output | Strobe 4 |
| 19 | GND | – | GND |
| 20 | GND | – | GND |
| 21 | GND | – | GND |
| 22 | VH | – | Power for print head |
| 23 | VH | – | Power for print head |
| 24 | VH | – | Power for print head |

Applicable Connector : 52806-2410 (Molex)

3.2 CN2 Connector for Print Mechanism (For Motor & Sensor)

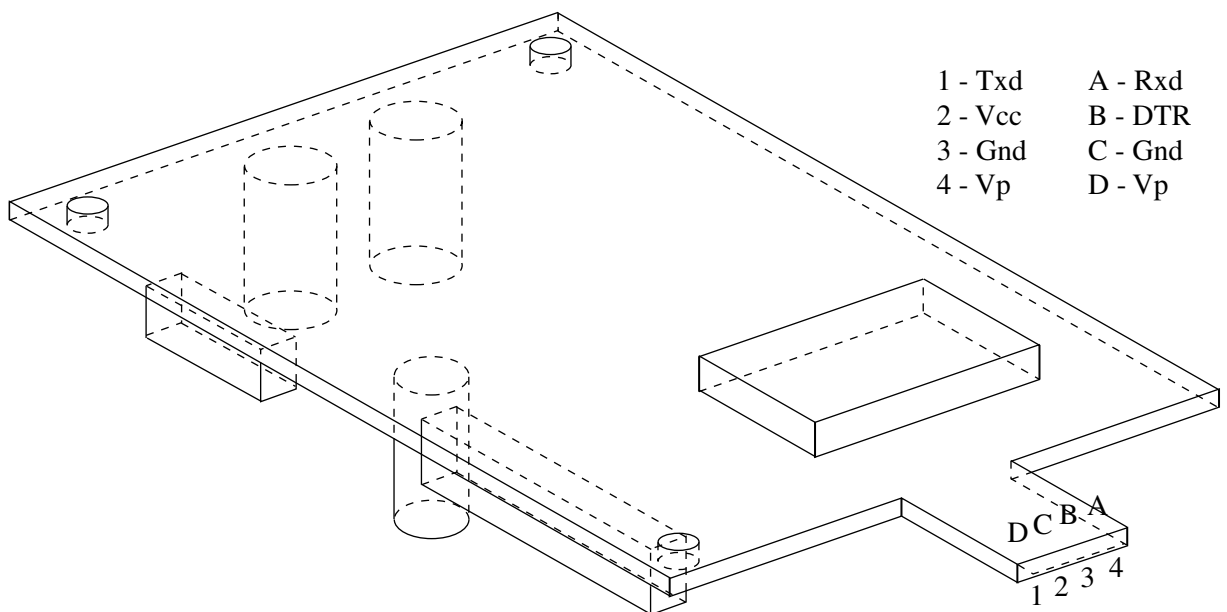
| Pin No. | Signal Name | I/O | Function |
|---------|-------------|--------|---|
| 1 | MOTOR B | Output | Operation signal for motor B |
| 2 | MOTOR A | Output | Operation signal for motor A |
| 3 | MOTOR B | Output | Operation signal for motor B |
| 4 | MOTOR A | Output | Operation signal for motor A |
| 5 | PE C | Input | Photo-transistor collector (Paper sensor) |
| 6 | GND | – | Photointerruptor emitter + cathode |
| 7 | PE A | – | Photo-LED anode (Paper sensor) |
| 8 | H-UP | Input | Head-up signal |
| 9 | GND | – | Head-up sensor GND |

Applicable Connector : 53047-0910 (Molex)

3.3 CN3 Connector for Interface

| Pin No. | Signal Name | I/O | Function |
|---------|-------------|--------|-------------------------------|
| 1 | TXD | Output | Serial Interface TXD |
| 2 | Vcc | — | Power supply for circuit (5V) |
| 3 | GND | — | GND |
| 4 | Vp | — | Power supply for operation |
| A | RXD | Input | Serial Interface RXD |
| B | DTR | Output | Serial Interface DTR |
| C | GND | — | GND |
| D | Vp | — | Power supply for circuit (5V) |

Applicable Connector: Amp 178217-2



⚠ CAUTION:

1. Control circuit requires power supply only for one pin of each VP and GND.
However, Operation voltage is to be supplied to all of pin for safety use.
2. Serial interface equips a driver and receiver of RS-232C, make sure to use it at RS-232C level.

4. JUMPER SETTING

(1) JUMPER 1

| Pin No. | Function | Short | Open | Factory Setting |
|---------|---------------|---|------------|-----------------|
| J1-1 | Not used | – | – | Open |
| J1-2 | CR Selection | LF Enable | LF Disable | Open |
| J1-3 | Print Density | Combination with J2-6 (See next page (5)) | | Open |
| J1-4 | DTR/XON-XOFF | XON-XOFF | DTR/DSR | Short |
| J1-5 | Baud Rate | See below (3) | | Open |
| J1-6 | " | | | Open |
| J1-7 | " | | | Short |
| J1-8 | " | | | Open |

(2) JUMPER 2

| Pin No. | Function | Short | Open | Factory Setting |
|---------|----------------------------------|--|----------------|-----------------|
| J2-1 | International Character set | See next page (4) | | Short |
| J2-2 | " | | | Short |
| J2-3 | " | | | Short |
| J2-4 | Not Used | – | – | Open |
| J2-5 | Print Drive System | Variable division | Fixed division | Short |
| J2-6 | Print Density (Supplementary) | Combination with J1-3 See next page (5) | | Short |
| J2-7 | Not Used | – | | Short |
| J2-8 | Mechanism | MLT-288 | MLT-289 | Open |

(3) INTERFACE & BAUD RATE

| J1-8 | J1-7 | J1-6 | J1-5 | Input Method | Parity | Baud Rate |
|-------|-------|-------|-------|--------------|--------|-----------|
| Open | Open | Open | Open | – | – | – |
| Open | Open | Open | Short | Serial Input | None | 1200 bps |
| Open | Open | Short | Open | " | " | 2400 bps |
| Open | Open | Short | Short | " | " | 4800 bps |
| Open | Short | Open | Open | " | " | 9600 bps |
| Open | Short | Open | Short | " | " | 19200 bps |
| Open | Short | Short | Open | " | Odd | 1200 bps |
| Open | Short | Short | Short | " | " | 2400 bps |
| Short | Open | Open | Open | " | " | 4800 bps |
| Short | Open | Open | Short | " | " | 9600 bps |
| Short | Open | Short | Open | " | " | 19200 bps |
| Short | Open | Short | Short | " | Even | 1200 bps |
| Short | Short | Open | Open | " | " | 2400 bps |
| Short | Short | Open | Short | " | " | 4800 bps |
| Short | Short | Short | Open | " | " | 9600 bps |
| Short | Short | Short | Short | " | " | 19200 bps |

(4) INTERNATIONAL CHARACTER SET

| J2-3 | J2-2 | J2-1 | InternationalCharacter |
|-------------|-------------|-------------|-------------------------------|
| Open | Open | Open | Japan (JIS) |
| Open | Open | Short | Japan (Shift-JIS) |
| Open | Short | Open | Sweden |
| Open | Short | Short | Denmark 1 |
| Short | Open | Open | U.K. |
| Short | Open | Short | Germany |
| Short | Short | Open | France |
| Short | Short | Short | U.S.A |

(5) PRINT DENSITY

| J1-3 | J2-6 | Print Density | Level | Print Density Rate |
|-------------|-------------|----------------------|--------------|---------------------------|
| Open | Open | Light | 0 | 80% |
| Open | Short | Standard | 1 | 100% |
| Short | Open | Slightly Dark | 2 | 120% |
| Short | Short | Dark | 3 | 150% |

Note:

1. Input Buffer is 2k byte. (Fixed)
 2. Serial data length is 8 bits. (Fixed)
- If print tone is set at 2 or above, printing rate tends to be lowered.

5. POWER SUPPLY

5.1 Specifications

VCC : 5V \pm 5% Approx. 130 mA

VP : 4.2V ~ 8.5V Approx. 1.5A (Peak : Approx. 4A) when 7.2V

Ordinal Voltage is to be 7.2V (Max). 8.5V is a voltage that is right after charging.

8.5V cannot be used for ordinal voltage.

5.2 Precautions

- (1) Design the product to supply power to Vcc before VP when power is supplied to this control board.
- (2) Design the product to turn off the power for Vcc after VP when power is turned off.
- (3) Make sure to turn off the power in case of connecting/disconnecting connectors.
- (4) Make sure to use Vcc and VP following their specifications.
- (5) Make sure to use this control board connecting all of terminals between VP and GND.

6. SERIAL INTERFACE

6.1 Specifications

(1) Data transfer system: Asynchronous

(2) Baud rates

1200, 2400, 4800, 9600, 19200 bps (Selectable by user)

(3) Configuration of one word

| | | |
|------------|---|--|
| Start bit | : | 1 bit |
| Data bit | : | 8 bits Fixed |
| Parity bit | : | Odd/Even or No parity (Selectable by user) |
| Stop bit | : | 1 bit or more |

(4) Signal polarity

RS-232C

- | | | |
|---------|---|------------------------|
| • Mark | = | logic “1” (−3V ~ −12V) |
| • Space | = | logic “0” (+3V ~ +12V) |

(5) Receiving data (RD signal)

RS-232C

- | | | |
|---------|---|---|
| • Mark | = | 1 |
| • Space | = | 0 |

(6) Receiving control (DTR signal)

RS-232C

- | | | |
|---------|---|--------------------------------|
| • Mark | : | Data transfer is not available |
| • Space | : | Data transfer is available |

(7) Transmission control (TD signal)

- | | | |
|----------------------|---|---------------------------------|
| DC1 code (11H) X-ON | : | Data reception is available |
| DC3 code (13H) X-OFF | : | Data reception is not available |

6.2 Explanation of Input/Output Signals

(1) RXD

Serial receiving data signal. On occurrence of framing error, overrun error, or parity error, the data is printed as “?”.

(2) DTR

When this signal is READY, write data or a command. When they are written in BUSY, overrun error is occurred and data is ignored. Data can be written into the input buffer even when the printer is busy printing. A BUSY also occurs when the printer is powered on, in test print, in Online mode, or being reset.

(3) TXD

If data remaining in the printer's input buffer is 256 bytes or less, the printer transfers a DC3 (13H: Data Receive Not Ready) signal to the host. If data in the input buffer exceeds 256 bytes, the printer transfers a DC1 (11H: Data Receive Ready) signal to the host.

(4) GND

Common GND on the circuit.

6.3 Error Detection

Parity, framing, and overrun are detected. On detection of any error, the data are stored in the buffer as “?”.

(1) Framing Error

With “space” state having been detected on detection of a stop bit, error takes place. The data are stored in the buffer as “?”.

(2) Parity Error

With an error having been detected under specifying parity check, the data is stored in the buffer as “?”.

(3) Overrun Error

On detection of an overrun error, the data are stored in the buffer as “?”.

6.4 Data Receiving Control

When DTR/DSR control having been selected, with BUSY signal at “LOW”, data from the host side are received. With the signal at “HIGH”, they can not be received.

When DTR/DSR control not having been selected, after X-ON transmission, data is received from the host side. No transmission of data can take place after X-OFF is transmitted.

6.5 Buffering

Data transfer to the input buffer include DTR signals and TD signals as the control signals concerned.

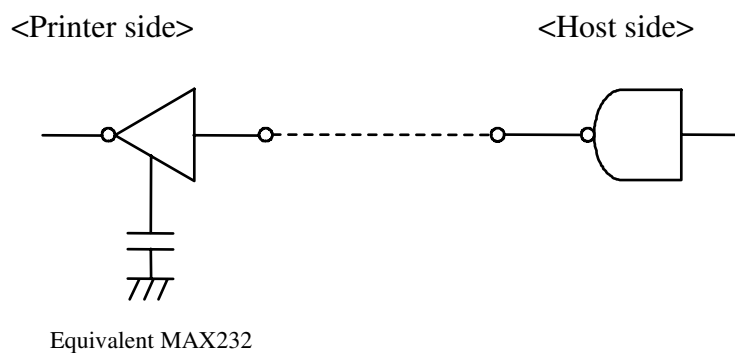
(1) DTR signals (See the page 7.2 (2))

(2) TXD signals (See the page 7.2 (3))

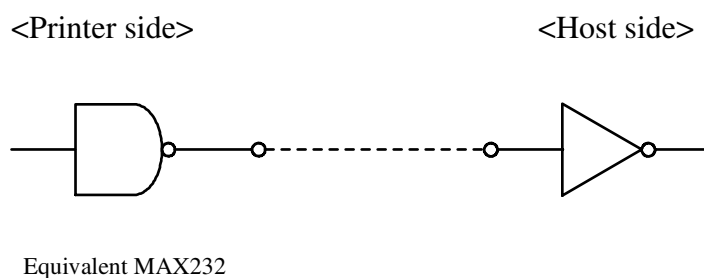
6.6 Electrical Characteristics

(1) RS-232C Circuit

Input (RXD, DSR)



Output (DTR, TXD)



7. ERROR HANDLING

7.1 Peripheral Circuit Errors

These errors are detected at power-on or initialization just after a reset.

(1) Error types

| Error | Description |
|--------------|---|
| Memory error | The CPU made a self-diagnosis of the circuit and detected an error with the external RAM. |

(2) External signal outputs

| Pin No | Signal Name | Remarks |
|--------|---------------------------|---|
| 20 | $\overline{\text{ERROR}}$ | LED output. For a blinking pattern, see 8.3 Error Indication. |
| 22 | DTR | Serial interface |

(3) Resetting methods

| Error | Resetting Method |
|--------------|------------------|
| Memory error | Unrecoverable |

7.2 Operation Errors

(1) Error types

| Error | Description |
|------------------------|--|
| No paper | The printing paper set is not set |
| Head –up | The head-up lever is at its up position |
| VH voltage error | A VH voltage is beyond its allowable range (4.2 to 8.5V) |
| Head temperature error | A head temperature is less than 0°C or 65 °C or higher. |

⚠ Caution: The 8.5V upper-limit voltage for VP voltage error is only an assumptive voltage just after charging the battery when using the battery power. It cannot be normally used. A normal maximum voltage is 7.2V.

(2) External signal outputs

| Pin No | Signal Name | Remarks |
|--------|-------------|------------------|
| B | DTR | Serial interface |

(3) Resetting methods

| Error | Resetting Method |
|------------------------|---|
| No paper | Set the paper. See Note 1. |
| Head –up | Bring down the head-up lever. |
| VP voltage error | Set to a voltage within the allowable range (4.2 to 8.5V) and turn on the power again. |
| Head temperature error | At the lower limit (less than 0 °C), printing becomes operational at 0 °C higher. At the upper limit (65 °C or higher), it become operational at 60 °C or lower. |

Caution:

The 8.5V upper-limit voltage for VP voltage error is only an assumptive voltage just after charging the battery when using the battery power. It cannot be normally used. A normal maximum voltage is 7.2V.

8. PRINTER MECHANISM CONTROL SYSTEM

8.1 Thermal Head Control System (Division Driving System)

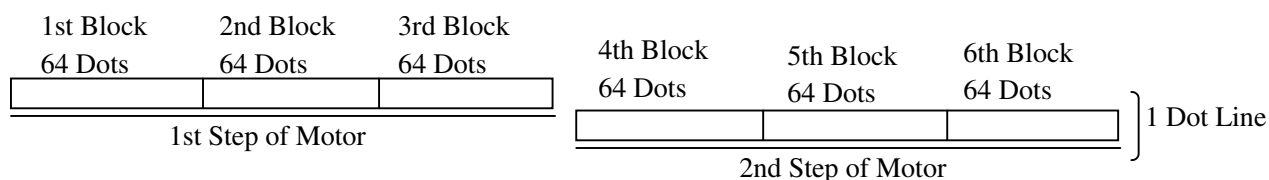
The MLT-289 (Line thermal printer) is driven by this control board has a 384 dots/line head divided into 6 blocks of 64 dots each. When actually driving the head, you can select either Fixed Division Number system, which drives the head, always dividing it into 6 blocks or Variable Division Number system which collectively drives several blocks at the time according to the number of activated head dots.

For selection by function selection, see 4. DIP SWITCH SETTING.

For selection by a command, see 11. PRINT CONTROL FUNCTIONS.

8.1.1 Fixed Division Number System

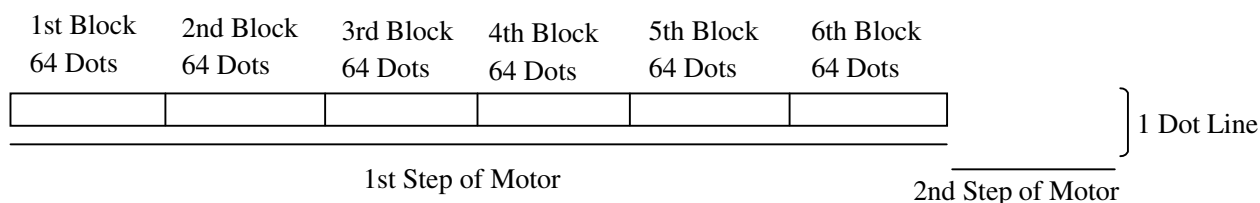
This system always drives each block in the same sequence.



Note: for a stepping motor driving method, see 9.2 Motor Drive.

8.1.2 Variable Division Number System

This system counts the number of printing dots for each block of the printing dot line and drives the blocks collective in such a manner not to exceed the maximum number of driving dots (64 dots).



8.2 Motor Drive

The MLT-289 uses a 4-phase bipolar stepping motor. It feeds the 1 dot line worth of paper in two steps by 2-to-2 phase excitation.

8.2.1 Motor Drive Features

- 1) Drive at an optimum drive speed by the VP voltage.
- 2) Prevents heat generation of the motor by PWM control to restrain current consumption.
- 3) Provides acceleration control at the time of start.

8.2.2 Maximum Motor Drive Speeds at Major Voltage

| VH Voltage | Motor Drive Speed |
|------------|-------------------|
| 5V | 400pps |
| 6V | 600pps |
| 7.2V | 840pps |

Caution: The maximum drive speed depends on the VH voltage.

A printing speed may slightly differ depending on a processing time or voltage detection accuracy. During the course of printing, a motor drive speed may be slower than the maximum drive speed, depending on what is printed or the head divided drive system.

9. PRINT CONTROL FUNCTIONS

9.1 Command List

Print Control Commands

| Control Code | Function | Code | Page |
|--------------|---|----------|------|
| LF | Printing and paper feed | 0Ah | 19 |
| CR | Print command | 0Dh | 20 |
| ESC J | Printing and feeding paper n/203 inch | 1Bh4Ah n | 21 |
| ESC d | Printing and feeding the paper by n lines | 1Bh64h n | 22 |

Print Character Commands

| Control Code | Function | Code | Page |
|--------------|---|-----------------------------------|------|
| ESC SP | Setting the right space amount of the character | 1Bh20h n | 23 |
| ESC ! | Collective specifying printing mode | 1Bh21h n | 24 |
| ESC % | Specifying/canceling download character set | 1Bh25h n | 26 |
| ESC & | Defining download characters | 1Bh26h s n m [ap1...ps×a]m-n+1 | 27 |
| ESC - | Specifying/canceling underline | 1Bh2Dh n | 29 |
| ESC E | Specifying/canceling highlighting | 1Bh45h n | 30 |
| ESC G | Specifying/canceling double printing | 1Bh47h n | 31 |
| ESC R | Selecting the international character set | 1Bh52h n | 32 |
| ESC V | Specifying/Canceling 90°-right- turned Characters | 1Bh56h n | 33 |
| ESC t | Selecting the character code table | 1Bh74h n | 34 |
| ESC { | Specifying/canceling the inverted characters | 1Bh7Bh n | 35 |

Print Position Commands

| Control Code | Function | Code | Page |
|--------------|-----------------------------------|---------------|------|
| HT | Horizontal tab command | 09h | 36 |
| ESC \$ | Specifying the absolute positions | 1Bh24Ah n1 n2 | 37 |
| ESC D | Setting horizontal tab position | 1Bh44[n]k 00h | 38 |
| ESC \ | Specifying the relative positions | 1Bh 5C n1 n2 | 39 |
| ESC a | Aligning the characters | 1Bh 61h n | 40 |

Line Feed Span Commands

| Control Code | Function | Code | Page |
|--------------|---|-----------|------|
| ESC 2 | Specifying 1/6-inch line feed rate | 1Bh 32h | 41 |
| ESC 3 | Setting line feed rate of minimum pitch | 1Bh 33h n | 42 |

Bit Image Commands

| Control Code | Function | Code | Page |
|--------------|----------------------------------|---------------------|------|
| ESC * | Specifying the bit image mode | 1Bh 2Ah m n1 n2[d]k | 43 |
| GS * | Defining the download, bit image | 1Dh 2Ah n1 n2 | 45 |
| GS / | Printing the download, bit image | 1Dh 2F | 47 |

Status Command

| Control Code | Function | Code | Page |
|--------------|---|---------|------|
| ESC v | Transmitting the printer status (Serial type) | 1Bh 76h | 48 |

Panel Switch Command

| Control Code | Function | Code | Page |
|--------------|---------------------------------------|---------------|------|
| ESC c5 | Enabling/disabling the panel switches | 1Bh 63h 35h n | 49 |

Macro Commands

| Control Code | Function | Code | Page |
|--------------|----------------------------------|------------------|------|
| GS : | Starting/ending macro definition | 1Bh 63h 35h n | 50 |
| GS ^ | Executing the macro | 1Dh 5Eh n1 n2 n3 | 51 |

Bar Code Commands

| Control Code | Function | Code | Page |
|--------------|--|---------------------|------|
| GS H | Selecting of print position of HRI code | 1Dh 48H n | 52 |
| GS f | Selecting the font of HRI code | 1Dh 66H n | 53 |
| GS h | Selecting the height of the bar code | 1Dh 68H n | 54 |
| GS k | Printing the bar code | 1Dh 6Bh n['d']k 00h | 55 |
| GS w | Selecting the horizontal size (scale factor) of bar code | 1Dh 77H n | 59 |

Other Commands

| Control Code | Function | Code | Page |
|--------------|----------------------------------|-----------|------|
| ESC = | Data input control | 1Bh 3Dh n | 60 |
| ESC @ | Initializing the Printer | 1Bh 40h | 61 |
| DC2 A | Selecting the Print drive system | 12h 41h n | 62 |

9.2 Command Details

9.2.1 Description of Items

XXXX

ALL

| | |
|-------------------------|---|
| [Function] | Command Function |
| [Code] | A sequence of code constituting a command is represented in hexadecimal number for < >H, binary number for < >B, and decimal number for < >, respectively; []k represents a repeat count of k-times. |
| [Range] | Describes an argument value(setting range) for the command. |
| [Outline] | Describes a command outline. |
| [Caution] | Describes a caution as required. |
| [Default] | Describes an initial value for the command when accompanied by an argument. |
| [See Also] | Describes the associated commands for use. |
| [Sample Program] | Describes a coding example in the Q-BASIC sample program. * This example is only for your reference and differs depending on the language used, version, and so on. For details, see the manual for the language used. |

LF

[Function] Printing and Paper Feed Command

[Code] <0A>H

[Outline] Prints data inside the input buffer and feeds lines based on the line feed amount having been set.

- The head of the line becomes the next print starting position.

[See Also] ESC 2, ESC 3

[Sample Program]

```
LPRINT "AAA" + CHR$ (&HA);  
LPRINT "BBB" + CHR$ (&HA);  
LPRINT CHR$ (&HA);  
LPRINT "CCC" + CHR$ (&HA);
```

[Print Results]

| | | |
|-----|---|---------------------|
| AAA | ← | Print and line feed |
| BBB | ← | Print and line feed |
| | ← | Line feed only |
| CCC | ← | Print and line feed |

CR

[Function] Print Command

[Code] <0D>H

[Outline] 1) When DS 1-2 is OFF:
 This command is ignored.
 2) When DS 1- 2 is ON:
 With data held inside the internal print buffer, printing and line feed are performed.
 Without data inside the internal print buffer, however, no printing is performed.

[See Also] LF

[Sample Program]

```
LPRINT "AAA" + CHR$ (&HD);  
LPRINT "BBB" + CHR$ (&HD);  
LPRINT CHR$ (&HD);  
LPRINT "CCC" + CHR$(&HD);
```

[Print Results]

| | |
|-----|-----------------------|
| AAA | ← Print and line feed |
| BBB | ← Print and line feed |
| | ← Line feed only |
| CCC | ← Print and line feed |

ESC J n

| | |
|-------------------|---|
| [Function] | Printing and feeding paper n/203 inch |
| [Code] | <1B>H<4A>H<n> |
| [Range] | {0 =< n =< FF} Data is described in Hex code. |
| [Outline] | <p>Prints data inside the print buffer and feeds paper by n/360 inch. Since an actual mechanical pitch is 1/203 inch, it is internally converted approximate to the value specified with this command.</p> <ul style="list-style-type: none">• Specified volume does not remain.• The beginning of the line is to be considered as the next printing start position.• Initial value is not defined. |

[Sample Program]**[Print Results]**

See Sample Program and Print Results for ESC 2 on Page 48.

ESC d n

[Function] Printing and Feeding the paper by n lines

[Code] <1B>H<64>H<n>

[Range] * {0 =< n =< FF} Data is described in Hex code.

[Outline] Prints data inside the buffer and feeds paper by n lines.

- Specified line does not remain.
- The beginning of the line is to be considered as the next printing start position.

[Default] • The initial value is not defined.

[Sample Program]

```
LPRINT "AAAAA"  
LPRINT CHR$ (&H1B) + "d" + CHR$ (2);  
LPRINT "AAAAA" + CHR$ (&HA);
```

[Print Results]

A A A A A
 ↑
 | 2/6-inch line feed
 ↓
A A A A A

ESC SP n

[Function] Setting the right space amount of the character

[Code] <1B>H<20>H<n>

[Range] {0 =< n=< 20} Data is described in Hex code.

[Outline] The rightward space amount is set in dot unit (1/203 inch unit). In the initial value, it is n=0.

[Caution] The rightward space amount in doublewide mode is made double of the set volume.

[Default] n = 0

[Sample Program]

```
LPRINT CHR$ (&H1B) + " " + CHR$ (0);
LPRINT "AAAAA" + CHR$ (&HA);
LPRINT CHR$ (&H1B) + " " + CHR$ (1);
LPRINT "AAAAA" + CHR$ (&HA);
LPRINT CHR$ (&H1B) + " " + CHR$ (12);
LPRINT "AAAAA" + CHR$ (&HA);
```

[Print Results]

```
A A A A A  ← 0-dot space
A A A A A  ← 1-dot space
A A A A A  ← 12-dot space
```

ESC ! n

[Function] Collective Specifying Printing Mode

[Code] <1B>H<21>H<n>

[Range] {0 =< n=< FF} Data is described in Hex code.

[Outline] Printing mode is assigned. Each n bit indicates the following:

| Bit | Function | Value | |
|-----|----------------|----------|-----------|
| | | 0 | 1 |
| 0 | Character Font | Font A | Font B |
| 1 | Undefined | | |
| 2 | Undefined | | |
| 3 | High-lighting | Canceled | Specified |
| 4 | Double height | Canceled | Specified |
| 5 | Double width | Canceled | Specified |
| 6 | Undefined | | |
| 7 | Underline | Canceled | Specified |

- [Caution]**
- With double height and double width being specified simultaneously, double wide and double high characters are consisted.
 - An underline is attached to the full character width, which, however, is not attached to the part having been skipped by the horizontal tab.
Neither is it attached to 90°-right-turned characters.
 - The underline width is as having been specified by <ESC ->.
(The default setting is 1 dot width.)
 - Specification with this command is invalid to Kanji, except specification and cancellation of highlighting
 - In case that double wide character and normal character exist in same one line, the layout of underline is consistent one.

[Default] n = 0

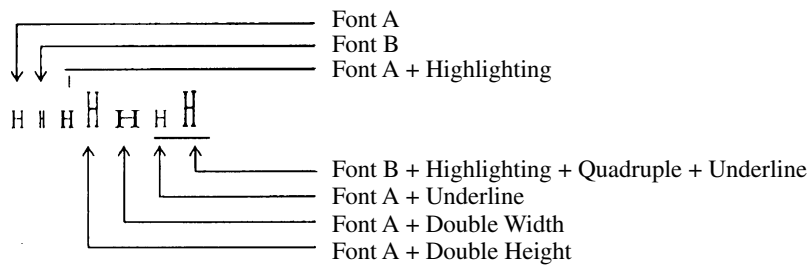
[See Also] ESC E,ESC –

[Sample Program]

```

LPRINT CHR$ (&H1B) + " !" + CHR$ (&H00) + "H" ;
LPRINT CHR$ (&H1B) + " !" + CHR$ (&H01) + "H";
LPRINT CHR$ (&H1B) + " !" + CHR$ (&H08) + "H";
LPRINT CHR$ (&H1B) + " !" + CHR$ (&H10) + "H";
LPRINT CHR$ (&H1B) + " !" + CHR$ (&H20) + "H";
LPRINT CHR$ (&H1B) + " !" + CHR$ (&H80) + "H";
LPRINT CHR$ (&H1B) + " !" + CHR$ (&HB9) + "H";
LPRINT CHR$ (&HA);

```

[Print Results]

ESC % n

[Function] Specifying/Canceling Download Character Set

[Code] <1B>H<25>H<n>

[Range] {0 =< n =< FF} data is described in Hex code.

[Outline] Specifying/canceling download characters.
Further, only the lowest bit (n0) is valid for n.

The lowest bit (n0) indicates the following.

| n0 | Function |
|----|-----------------------------------|
| 0 | Canceling download character set |
| 1 | Specifying download character set |

[Caution] Download characters and download bit images cannot be defined simultaneously.

[Default] n = 0

[See Also] ESC &

[Sample Program]

| | | | | |
|--|------|-------|-------|------|
| GOSUB SETCHR | DATA | 6 | | |
| LPRINT CHR\$ (&H1B) + "%" + CHR\$ (0); | DATA | &HFF, | &H80, | &H00 |
| LPRINT "@A" + CHR\$ (&HA); | DATA | &H80, | &H80, | &H00 |
| LPRINT CHR\$ (&H1B) + "%" + CHR\$ (1); | DATA | &H80, | &H80, | &H00 |
| LPRINT "@A" + CHR\$ (&HA); | DATA | &H80, | &H80, | &H00 |
| END | DATA | &HFF, | &HFF, | &HFF |
| SETCHR: | DATA | &HFF, | &HFF, | &HFF |
| LPRINT CHR\$ (&H1B) + "&"; | DATA | 12 | | |
| LPRINT CHR\$ (3) + "@" + "A"; | DATA | &HFF, | &HFF, | &HFF |
| FOR J=1 TO 2 | DATA | &H80, | &H07, | &HF9 |
| READ REP | DATA | &H80, | &HFF, | &HF9 |
| LPRINT CHR\$ (REP); | DATA | &H87, | &HFE, | &H01 |
| FOR I=1 TO REP*3 | DATA | &H9F, | &H06, | &H01 |
| READ D | DATA | &HF8, | &H06, | &H01 |
| LPRINTCHR\$ (D); | DATA | &HF8, | &H06, | &H01 |
| NEXT I | DATA | &H9F, | &H06, | &H01 |
| NEXT J | DATA | &H87, | &HFE, | &H01 |
| RETURN | DATA | &H80, | &HFF, | &HF9 |
| | DATA | &H80, | &H07, | &HF9 |
| | DATA | &HFF, | &HFF, | &HFF |

[Print Results]

@ A ← Internal Character Set

□ A ← Download Character

ESC & s n m [a [p] s × a] m – n +1

[Function] Defining Download Character

[Code] <1B>H<26>H<s><n><m> [<a><p1><p2><ps×a>]m-n+1

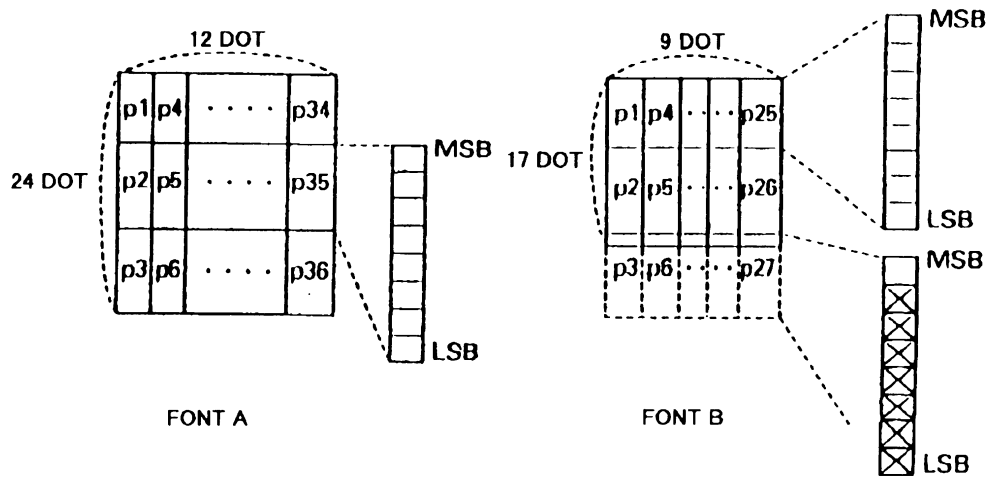
[Range] {s = 03}
 {20 (Hex) =< n =< m =< 7E (Hex)}
 {0 =< a =< 0C(Hex)} (Font A)
 {0 =< a =< 0A(Hex)} (Font B)

[Outline] Defines the font of download characters of alphanumeric characters.

- "s" indicates the number of bytes in vertical direction.
- "n" indicates the start character code and m the end character code. To define only one character, set n=m.
- Character codes definable includes 95 ASCII codes in total between <20>H~<7E>H.
- "a" indicates the number of dots in horizontal direction for definition.
- "p" is the data to be defined, which indicate a pattern equal to "a" dot in horizontal direction from the left end. The rest of the pattern on the right side is filled with space.
 The rest of data to be defined is s × a.
- Download characters thus defined remain valid until redefinition, ESC @ execution, GS * execution, or power OFF is practiced.

[Caution] Download characters and download bit images can not be defined simultaneously.
 Running this command clears the definition of the download bit image.

[Default] Same as the internal character set

[Example]

Create each data bit by setting "1" for a printed dot and "0" for an unprinted dot.

[Sample Program]**[PrintResults]**

See Sample Program and Print Results for ESC % on Page 33.

ESC – n

[Function] Specifying/ Canceling Underline

[Code] <1B>H<2D>H<n>

[Range] {0 =< n =< 02} data is described in Hex code.

[Outline] Specifying/canceling an underline.

- Types of underlines by n value are shown below:

| n (Hex) | Type |
|---------|---|
| 0 | Canceling an underline. |
| 1 | Specifying an underline for 1-dot width. |
| 2 | Specifying an underline for 2-dots width. |

- [Caution]**
- An underline is attached to the full character width. It is, however, not attached to the part having been skipped by horizontal tab command.
 - An underline is not attached to a 90 °- right-turned characters.
 - Specification/cancellation with this command is invalid to Kanji.

[See Also] ESC !, FS –

[Sample Program]

```
LPRINT CHR$ (&H1B) + "-" + CHR$ (0);
LPRINT "AAAAA" ;
LPRINT CHR$ (&H1B) + "-" + CHR$ (1);
LPRINT "AAAAA" + CHR$ (&HA);
```

[Print Results]

Underline Canceled
 A A A A A A A A A A
 Underline Specified

ESC E n

[Function] Specifying/canceling highlighting

[Code] <1B>H<45>H<n>

[Range] {0 =< n =<FF} Data is described in Hex code.

[Outline] Specifying/canceling the highlighting characters.

- "n" is valid only for the lowest bit (n0).
- Control by the lowest bit (n0) is shown as follows:

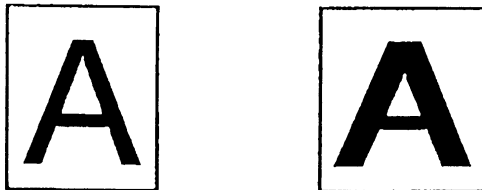
| n0 | Type |
|----|--------------------------|
| 0 | Canceling highlighting. |
| 1 | Specifying highlighting. |

- This is effective to all characters.
- Dot configuration of a highlighted character includes one extra dot added at its side.

[Caution] • The print result of Double printing and highlight character printing is completely same.

[See Also] ESC !

[Example]



[Sample Program]

```
LPRINT CHR$ (&H1B) + "E" + CHR$ (0);
LPRINT "AAABBB" + CHR$ (&HA);
LPRINT CHR$ (&H1B) + "E" + CHR$ (1);
LPRINT "AAABBB" + CHR$ (&HA);
```

[Print Results]

```
A A A B B B ← Highlighting canceled
A A A B B B ← Highlighting canceled
```

ESC G n

[Function] Specifying/canceling Double Printing

[Code] <1B>H<47>H<n>

[Range] {0 =< n =< FF} Data is described in Hex code.

[Outline] Specifying/canceling the double printing.

- "n" is valid only for the lowest bit (n0).
- Control by n is shown as follows.

| n0 | Type |
|----|-----------------------------|
| 0 | Canceling double printing. |
| 1 | Specifying double printing. |

- This is effective to all characters.

[Caution] • The print result of Double printing and highlight character printing is completely same.

[See Also] ESC E

[Sample Program]

```
LPRINT CHR$ (&H1B) + "G" + CHR$ (0);
LPRINT "AAABBB" + CHR$ (&HA);
LPRINT CHR$ (&H1B) + "G" + CHR$ (1);
LPRINT "AAABBB" + CHR$ (&HA);
```

[Print Results]

A A A B B B ← Highlighting canceled

A A A B B B ← Highlighting canceled

ESC R n

[Function] Selecting the International Character set

[Code] <1B>H<52>H<n>

[Range] {0 =< n =< 0A) Data is described in Hex code.

[Outline] Depending on the value of n, following character sets are specified.

| n(Hex) | Character Set |
|--------|---------------|
| 0 | U.S.A. |
| 1 | France |
| 2 | Germany |
| 3 | U.K. |
| 4 | DenmarkI |
| 5 | Sweden |
| 6 | Italy |
| 7 | Spain |
| 8 | Japan |
| 9 | Norway |
| A | DenmarkII |

[Default] • The initial value of n indicates the character set specified by Jumper (J1~J3).

[See Also] Character Code Table (International Character Set)

[Sample Program]

```
FOR I=0 TO 10
  LPRINT CHR$ (&H1B) + "R" + CHR$ (I);
  LPRINT " #${¥}^";
  LPRINT CHR$ (&H60) + "{¥} ~";
  LPRINT "n=" + STR$ (I);
  LPRINT CHR$ (&HA);
NEXT I
```

[Print Results]

```
#$@[\]^`{|}~ n = 0
#$à°ç§^`éùè~ n = 1
#$§ÄÖÜ^`äöüß n = 2
£$@[\]^`{|}~ n = 3
#$@ÆØÅ^`æøå~ n = 4
#¤ÉÄÖÅÜéäöåü n = 5
#$@°\é^`üäöèï n = 6
£$@;ñ¿^`~ n = 7
#$@[¥]^`{|}~ n = 8
#¤ÆØÅÜéæøåü n = 9
#$ÆØÅÜéæøåü n = 10
```

ESC V n

[Function] Specifying/Canceling 90°-right- turned Characters

[Code] <1B>H<56>H<n>

[Range] {0 =< n =< 1} Data is described in Hex code.

[Outline] Specifying/canceling characters 90°-right- turned character.

- "n" means the followings.

| n (Hex) | Condition |
|---------|---|
| 0 | Canceling 90°-right- turned Characters |
| 1 | Specifying 90°-right- turned Characters |

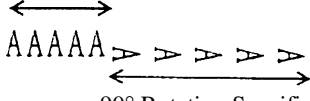
[Caution] • No underlines are attached to 90°-right- turned characters.

[Default] • The initial value of n is "0".

[Sample Program]

```
LPRINT CHR$ (&H1B) + "V" + CHR$ (0);
LPRINT "AAAAA";
LPRINT CHR$ (&H1B) + "V" + CHR$ (1);
LPRINT "AAAAA" + CHR$ (&HA);
```

[Print Results]

90° Rotation Canceled

 90° Rotation Specified

ESC t n

[Function] Selecting Character Code Table

[Code] <1B>H<74>H<n>

[Range] {0 =< n =< 1} Data is described in Hex code.

Selecting Page n on the character code table:

The character code table is selected depending on the value of n.

"n" means the followings.

| n (Hex) | Condition |
|---------|---------------------------|
| 0 | Page0(IBM Character #2) |
| 1 | Page1(Domestic Character) |

[Default] The initial value of n is subject to the character set for the country specified by the Jumper(J1~J3).

- When Japan is selected: Domestic characters
- When non-Japan is selected: IBM characters #2

[See Also] Character Code Table

[Sample Program]

```
LPRINT CHR$ (&H1B) + "t" + CHR$ (0);
LPRINT " n=0    ";
FOR C=&HB1 TO &HB5
LPRINT CHR$ (C);
NEXT C
LPRINT CHR$ (&HA);
LPRINT CHR$ (&H1B) + "t" + CHR$ (1);
LPRINT " n=1    ";
FOR C=&HB1 TO &HB5
LPRINT CHR$ (C);
NEXT C
LPRINT CHR$ (&HA);
```

[Print Results]

n = 0 𐤀𐤁𐤂𐤃𐤄𐤅 ← Page 0
 n = 1 アイウエ ← Page 1

ESC { n

[Function] Specifying/Canceling the Inverted Characters

[Code] <1B>H<7B>H<n>

[Range] {0 =< n =< FF} Data is described in Hex code.

[Outline] Specifying/canceling inverted characters.

- "n" is valid only for the lowest bit (n0).
- Bit n (n0) means the followings.

| n0 | Condition |
|----|---------------------------------|
| 0 | Canceling inv rted characters. |
| 1 | Specifying inverted characters. |

[Caution]

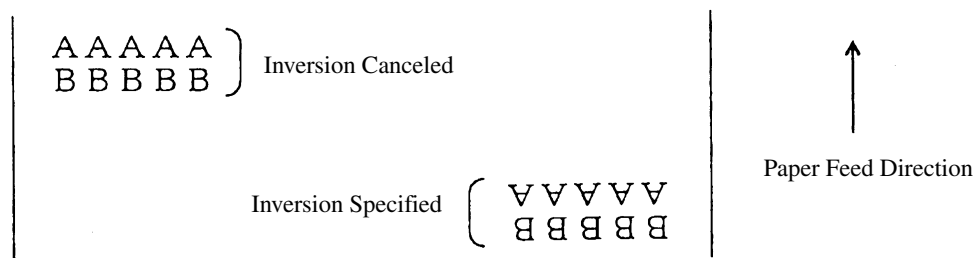
- Inverted-printing means printing the line at 180°turned.
- This is valid only when this is specified at the beginning of a line.

[Default] • The initial value of n is "0".

[Sample Program]

```
LPRINT CHR$ (&H1B) + "{" + CHR$ (0);
LPRINT "AAAAA" + CHR$ (&HA);
LPRINT "BBBBB" + CHR$ (&HA);
LPRINT CHR$ (&H1B) + "{" + CHR$ (1);
LPRINT "AAAAA" + CHR$ (&HA);
LPRINT "BBBBB" + CHR$ (&HA);
```

[Print Results]



HT

[Function] Horizontal Tab Command

[Code] <09>H

[Outline] Shifts the printing position to the next horizontal tab position.

- Ignored when the next horizontal tab position has not been set.

[Caution]

- The horizontal tab position is set by ESC D.
- Initial setting of the horizontal tab position is each 8 characters in 9th, 17th, 25th, columns.

[See Also] ESC D

[Sample Program]

```
LPRINT "0123456789012345678901";  
LPRINT CHR$ (&HA);  
LPRINT CHR$ (&H9) + "AAA";  
LPRINT CHR$ (&H9) + "BBB";  
LPRINT CHR$ (&HA);  
LPRINT CHR$ (&H1B) + "D";  
LPRINT CHR$ (3) + CHR$ (7) + CHR$ (14) + CHR$ (0);  
LPRINT CHR$ (&H9) + "AAA";  
LPRINT CHR$ (&H9) + "BBB";  
LPRINT CHR$ (&H9) + "CCC" + CHR$ (&HA);
```

[Print Results]

```
012345678901234567890 1  
          AAA      BBB      ← Initially set horizontal tab  
AAA BBB      CCC      ← When set to the 4th, 8th, and 15th digits
```


ESC \$ n1 n2

[Function] Specifying the Absolute Positions

[Code] <1B>H<24>H<n1><n2>

[Range] {0 =< n1 =< FF}
{0 =< n2 =< 1} Data is described in Hex code.

[Outline] The printing start position is specified in the number of dots (1/203 inch unit) from the beginning of line.

- The number of dots is divided by 256, whose quotient is taken as n2 and the residual as n1.
- Therefore, the printing start position is equal to n1+n2 x 256 from the beginning of line.

[Caution] • Specifying beyond the line end is ignored.

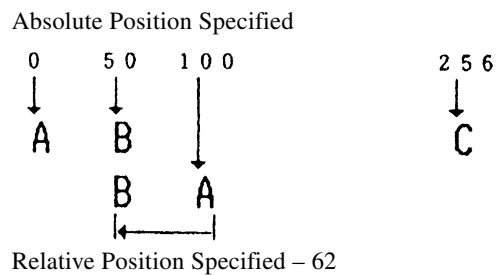
[Default] • The initial value is not specified.

[See Also] ESC \

[Sample Program]

```
LPRINT CHR$ (&H1B) + "$";
LPRINT CHR$ (0) + CHR$ (0) + "A";
LPRINT CHR$ (&H1B) + "$";
LPRINT CHR$ (50) + CHR$ (0) + "B";
LPRINT CHR$ (&H1B) + "$";
LPRINT CHR$ (0) + CHR$ (1) + "C";
LPRINT CHR$ (&HA);
LPRINT CHR$ (&H1B) + "$";
LPRINT CHR$ (100) + CHR$ (0) + "A";
LPRINT CHR$ (&H1B) + "¥";
LPRINT CHR$ (&HC2) + CHR$ (&HFF) + "B";
LPRINT CHR$ (&HA);
```

[Print Results]



ESC D [n] k NUL

[Function] Setting Horizontal Tab Position

[Code] <1B>H<44>H [<n>] k<00>H

[Range] { 0 =< n =< FFH } Data is described in Hex code.
 { 0 =< k =< 20H } Data is described in Hex code.

[Outline] Specifying a horizontal tab position.

- "n" indicates the no. of columns from the beginning to the horizontal tab position.
 At this time, n= set position – 1 is to be specified. For example, to set the position at 9th column, n=8 is to be specified.
- k denotes the number of horizontal tab positions you want to set.
- The tab position is set at position where it is "character width x n" from the line beginning.
 The character width, at this time, includes the rightward space amount.
 In double wide characters, it is made double of the ordinary case.
- Tab positions can be specified are maximum 32. Specifying exceeding this is ignored.
- <n> k, which denotes a setting position, is input in the increasing order and ends at <00> H.
- ESC D NUL clears all the set tab positions. Following clearing, horizontal tab command is ignored.

[Caution] When the data, <n> k, is equal to or smaller than its preceding data, <n> k-1, it is assumed that tab setting is finished. If this is the case, the next data onward will be processed as normal data.

When the data, <n> k, exceeds a 1-line print area, set the horizontal tab position, assuming "Set digit position = Maximum print digits + 1." The horizontal tab position does not change even if the character width is altered after setting the horizontal tab position.

[Default] • Initial value is specified for each eight characters(9th.17th.25th column) of ANK characters.

[See Also] HT

[Sample Program]

[Print Results]

See Sample Program and Print Results for HT on Page 43.

ESC \ n1 n2

[Function] Specifying the Relative Positions

[Code] <1B>H<5C>H<n1><n2>

[Range] {0 =< n1 =< FF}
{0 =< n2 =< FF} Data is described in Hex code.

[Outline] The printing start position is specified in the number of dots(1/203 inch unit) from the current position.

- Rightward direction is taken as plus and leftward direction as minus.
- To specify N dot in minus (left) direction, use a complement of N for assignment.
-N dots = 65536 - N
- The number of dots is divided by 256, whose quotient is taken as n2 and the residual as n1.

[Caution] • Specifying exceeding the top of line or the end of line is ignored.

[Default] • The initial value is not specified.

[See Also] ESC \$

[Sample Program] **[Print Results]**

See Sample Program and Print Results for ESC \$ on Page 44.

ESC a n

[Function] Aligning the characters

[Code] <1B>H<61>H<n>

[Range] {0 =< n =< 2} Data is described in Hex code.

[Outline] All the printed data within one line are aligned in the specified position.

- Depending on n value, positional alignment is carried out as in the table below:

| n (Hex) | Position |
|---------|---------------------|
| 0 | Left end alignment |
| 1 | Centering |
| 2 | Right end alignment |

- [Caution]**
- This is valid only when n is inputted at the beginning of line.
 - The initial value of n is "0".

[Sample Program]

```
LPRINT CHR$ (&H1B) + "a" + CHR$ (0);
LPRINT "AAAAA" + CHR$ (&HA);
LPRINT CHR$ (&H1B) + "a" + CHR$ (1);
LPRINT "AAAAA" + CHR$ (&HA);
LPRINT CHR$ (&H1B) + "a" + CHR$ (2);
LPRINT "AAAAA" + CHR$ (&HA);
```

[Print Results]



ESC 2

[Function] Specifying 1/6-inch line feed rate

[Code] <1B>H<32>H

[Outline] The line feed rate per line is specified by 1/6 inch.

[Sample Program]

```
LPRINT "AAAAA" + CHR$ (&HA);
LPRINT CHR$ (&H1B) + "3" + CHR$ (0);
LPRINT "AAAAA" + CHR$ (&HA);
LPRINT CHR$ (&H1B) + "3" + CHR$ (50);
LPRINT "AAAAA" + CHR$ (&HA);
LPRINT CHR$ (&H1B) + "2";
LPRINT "AAAAA" + CHR$ (&HA);
LPRINT "AAAAA";
LPRINT CHR$ (&H1B) + "J" + CHR$ (100);
LPRINT "AAAAA" + CHR$ (&HA);
LPRINT "AAAAA" + CHR$ (&HA);
```

[Print Results]

```
A A A A A 1/6-inch line feed
A A A A A 0/360-inch line feed
A A A A A 50/360-inch line feed
A A A A A 1/6-inch line feed
A A A A A 100/360-inch line feed
A A A A A 1/6-inch line feed
A A A A A
```

ESC 3 n

[Function] Setting line feed rate of minimum pitch

[Code] <1B>H<33>H<n>

[Range] {0 =< n =< FF} Data is described in Hex code.

[Outline] The line feed rate per line is specified by n/360 inch.
Since an actual mechanical pitch is 1/203 inch, it is internally converted approximate
to the value specified with this command.

[Default] • The initial value is n = 60 (1/6 inch) (18H), being 4.23 mm line feed rate.

[Sample Program] **[Print Results]**

See Sample Program and Print Results for ESC 2 on Page 48.

ESC * m n1 n2 [d] k**[Function]** Specifying the Bit Image Mode**[Code]** <1B>H<2A>H<m><n1><n2> [<d>] k**[Range]** {m= 0, 1, 32, 33 bit image mode (See the table below.)}

{0 =< n1 =< FF(Hex)}

{0 =< n2 =< 03(Hex)}

{0 =< d =< FF(Hex)}

{k = n1 + FF(Hex) × n2 (m = 0, 1)}

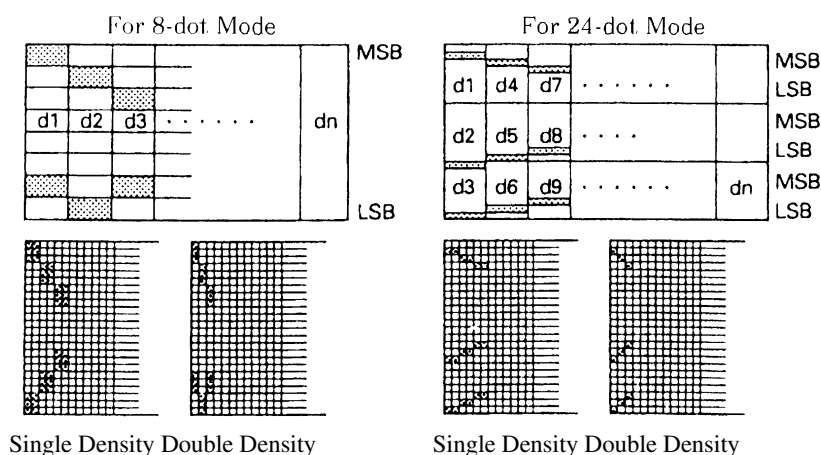
{k = (n1+ FF(Hex)×n2)×3} (m = 32, 33)

[Outline] According to the number of dots specified in n1, n2, specify the bit image of mode n.

- The No. of dots printed is divided by 256, whose quotient is taken as n2 and residual as n1.
- The total no. of dots printed in the bit image is equal to n1 + (256 x n2).
- When bit image data have been input in excess of dot position of one line (448 dots) , the excess data are discarded.
- d is bit image data, the bits subject to printing are taken as "1" and those not as "0".
- The bit image modes specified by m are shown as follows:

| m(Hex) | Mode | Vertical Direction | | Horizontal Direction | |
|--------|-----------------------|--------------------|-------------|----------------------|------------------|
| | | No. of Dots | Dot Density | Dot Density | Max. No. of Dots |
| 0 | 8-dot single density | 8 | 67 DPI | 101 DPI | 192 |
| 1 | 8-dot double density | 8 | 67 DPI | 203 DPI | 384 |
| 32 | 24-dot single density | 24 | 203 DPI | 101 DPI | 192 |
| 33 | 24-dot double density | 24 | 203 DPI | 203 DPI | 384 |

- [Caution]**
- When the values set in m (bit image mode) are out of the above range, the data following after n1 is processed as normal printing data.
 - After completion of bit image printing, printer returns to normal data processing mode.

[Example]

[Sample Program]

```

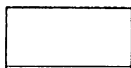
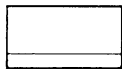
LPRINT CHR$ (&H1B) + "***";
LPRINT CHR$ (0) + CHR$ (20) + CHR$ (0);
GOSUB IMG1
LPRINT CHR$ (&HA);
LPRINT CHR$ (&H1B) + "***";
LPRINT CHR$ (1) + CHR$ (20) + CHR$ (0);
GOSUB IMG1
LPRINT CHR$ (&HA);
LPRINT CHR$ (&H1B) + "***";
LPRINT CHR$ (32) + CHR$ (20) + CHR$ (0);
GOSUB IMG2
LPRINT CHR$ (&HA);
LPRINT CHR$ (&H1B) + "***";
LPRINT CHR$ (33) + CHR$ (20) + CHR$ (0);
GOSUB IMG2
LPRINT CHR$ (&HA);
END

```

```

IMG1 :
LPRINT CHR$ (&HFF) ;
FOR I=1 TO 18
LPRINT CHR$ (&H85) ;
NEXT I
LPRINT CHR$ (&HFF) ;
RETURN
IMG2 ;
LPRINT CHR$ (&HFF) ;
LPRINT CHR$ (&HFF) ;
LPRINT CHR$ (&HFF) ;
FOR I=1 TO 18
LPRINTCHR$ (&H80) ;
LPRINTCHR$ (&H00) ;
LPRINTCHR$ (&H05) ;
NEXT I
LPRINT CHR$ (&HFF) ;
LPRINT CHR$ (&HFF) ;
LPRINT CHR$ (&HFF) ;
RETURN

```

[Print Results]

GS * n1 n2 [d] n1 × n2 × 8

- [Function]

Defining the Download Bit Image
- [Code]

<1D>H<2A>H<n1><n2> [<d>] n1 × n2 × 8
- [Range]

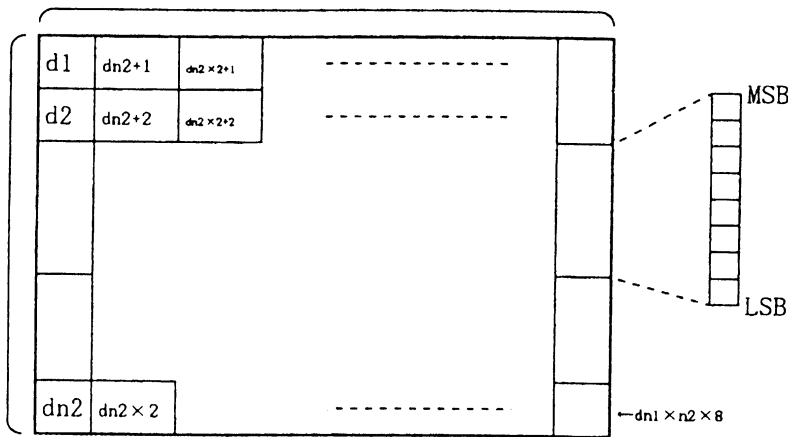
{ 1 =< n1 =< FF}
{ 1 =< n2 =< 30}
{n1 n2 =< 51F} Data is described in Hex code.
- [Outline]

Defines downloading bit images of the number of dots specified by n1/n2.

 - The numbers of dots are n1 x 8 in horizontal direction and n2 x 8 in vertical direction.
 - d indicates bit image data.
 - The download bit image thus defined remains effective until redefinition, ESC @ execution, ESC &, or power OFF takes place.
- [Caution]

- A download character and a download bit image can not be defined simultaneously.
With this command executed, defined content of a download character is cleared.
 - Relations between the bit image data and the dot defined are shown below:
 - If a download bit image is defined with this command while it is being printed (GS/), printing operation may become unstable (fluctuating print pitch).
- [See Also]

GS /

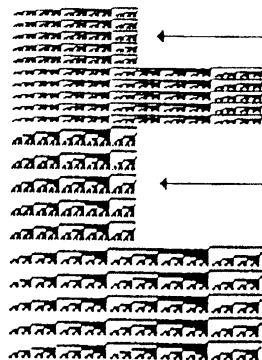


[Sample Program]

```

GOSUB IMG
LPRINT CHR$ (&H1D) + "/" + CHR$ (0);
LPRINT CHR$ (&H1D) + "/" + CHR$ (1);
LPRINT CHR$ (&H1D) + "/" + CHR$ (2);
LPRINT CHR$ (&H1D) + "/" + CHR$ (3);
END
IMG:
n 1 = 10 : n 2= 5
LPRINT CHR$ (&H1D) + "*";
LPRINT CHR$ (n1) + CHR$ (n2);
FOR J=1 TO n1*8
FOR I=1 TO n2
LPRINT CHR$ (J);
NEXT I
NEXT J
RETURN

```

[Print Results]


← Normal Mode

← Double Width Mode

← Double Height Mode

← Quadruple Mode

GS / m

[Function] Printing the Download, Bit Image

[Code] <1D>H<2F>H<m>

[Range] {0 =< m =< 03} Data is described in Hex code.

[Outline] Prints download bit image in a mode specified by m.

- Modes can be selected by m are shown below.

| m | Mode Name | Dot Density in Vertical Direction | Dot Density in Horizontal Direction |
|---|------------------------------|-----------------------------------|-------------------------------------|
| 0 | Normal mode | 203 DPI | 203 DPI |
| 1 | Double wide mode | 203 DPI | 101 DPI |
| 2 | Double high mode | 101 DPI | 203 DPI |
| 3 | Double wide/double high mode | 101 DPI | 101 DPI |

- [Caution]**
- When data exist inside the print buffer, this command is ignored.
 - When a download bit image has not been defined, this command is ignored.
 - A portion of a download bit image exceeding one line length is not printed.
 - A download character and a download bit image cannot be defined simultaneously.
 - If a download bit image data is defined while it is being printed with this command, printing operation may become unstable (fluctuating print pitch).

- [Default]**
- The initial value is not specified.

[See Also] GS *

[Sample Program]

[Print Results]

See Sample Program and Print Results for GS * on Page 52.

ESC v (Serial Interface Only)

[Function] Transmitting the printer status (Serial Type)

[Code] <1B>H<76>H

[Outline] Current printer status is transmitted.

- [Caution]**
- Status sent out consists of 1 byte whose content is as in the table below.
 - In DTR/DSR control, after revertible state of the host (DSR signal being in SPACE state) is confirmed, only 1 byte is transmitted. In XON/XOFF control, DSR signal state not being confirmed, only 1 byte is transmitted.
 - In DTR/DSR control, when the host is in unrespectable state (DSR signal being in MARK state), it waits until receptacle state is created.
 - In paper end (paper near end) status, this command may be unrespectable state due to BUSY state.

Remarks. This command is valid only for serial interface model.

| Bit | Function | Value | |
|-----|-------------|------------|---------------|
| | | 0 | 1 |
| 0 | Not defined | | |
| 1 | Not defined | | |
| 2 | Paper end | With paper | Without paper |
| 3 | Not defined | | |
| 4 | Not used | Fixed to 0 | — |
| 5 | Not defined | | |
| 6 | Not defined | | |
| 7 | Not defined | | |

[Sample Program]

```
OPEN "COM1: N81NN" AS #1;
PRINT #1, CHR$ (&H1B) + "v";
A$ = INPUT$ (1, #1);
CLOSE #1
```

ESC c5 n

[Function] Enabling/Disabling Panel Switches

[Code] <1B>H<63>H<35>H<n>

[Range] {0 =< n =< FF} Data is described in Hex code.

[Outline] Selecting the LF switch valid/invalid.

- "n" is valid only in the lowest bit (n0).
- "n" bit means the followings.

| n0 | Condition |
|----|---------------|
| 0 | LFSW valid. |
| 1 | LFSW invalid. |

[Caution] When the panel switch is disabled with this command, the LF switch is disabled. Therefore, the paper cannot be fed by operating the LF switch.

[Default] • The initial value of n is "0".

[Sample Program]

```
LPRINT CHR$ (&H1B) + "c5" + CHR$ (0); .....When enabling the LF switch
LPRINT CHR$ (&H1B) + "c5" + CHR$ (1); .....When disabling the LF switch
```

GS :

[Function] Starting / Ending Macro Definition

[Code] <1D>H<3A>H

[Outline] Specifying starting / ending macro definition.
Means termination when received while defining a macro.

[Caution] Maximum content available for macro definition is 2048 bytes.
A portion exceeding 2048 bytes is not defined.

- Even with ESC @ (initialization of the printer) having been executed, defined content is not cleared. Therefore, it is possible to include ESC @ into the content of macro definition.
- Normal printing operation is carried out even while in macro definition

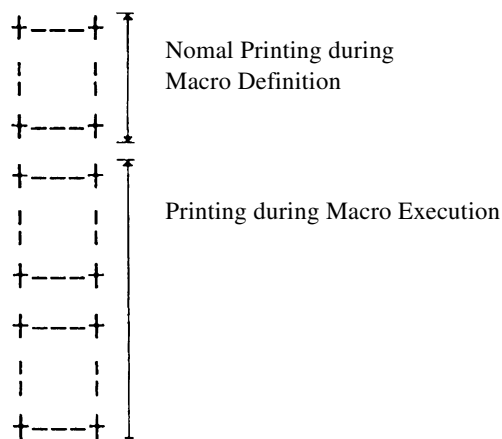
[Default] • Initially, Macro is not specified.

[See Also] GS ^

[Sample Program]

```
LPRINT CHR$ (&H1D) + “: ” ;
LPRINT "+——+" + CHR$ (&HA);
LPRINT " |      | " + CHR$ (&HA);
LPRINT "+——+" + CHR$ (&HA);
LPRINT CHR$ (&H1D) + “: “;
LPRINT CHR$ (&H1D) + " ^ “;
LPRINT CHR$ (2) + CHR$ (10);
LPRINT CHR$ (0);
```

[Print Results]



GS ^ n1 n2 n3

[Function] Executing the Macro

[Code] <1D>H<5E>H<n1><n2><n3>

[Range] {0 =< n1 =< FF}
 {0 =< n2 =< FF}
 {0 =< 3 =< 1} Data is described in Hex code.

[Outline] Executing contents defined in macro.

- "n1~ n3" indicate as follows:

n1 : The number of times of macro execution

n2 : Waiting time on macro execution

Waiting time of n2 x 100msec is given for every execution.

n3 : Macro execution mode

| n3 | Mode |
|----|----------------------|
| 0 | Continuous execution |
| 1 | Execution by LFSW |

Continuous execution: The Macro is executed n1 times continuously at the time intervals specified by n2.

Execution by FEED S: After waiting for lapse of time specified by n2, the ALAME LED flickers and the LF switch is waited to be pressed. When it is pressed, the macro is executed once.
 This action is repeated n1 times.

- [Caution]**
- When this command is received while in macro definition, suspension of macro definition is indicated. At this time, the defined content is cleared.
 - No execution takes place when macro is held undefined or n1=0.
 - While in macro execution with n3=1, paper feed with the LF SW is not available.

[Default] • Initially, this command is not specified.

[See Also] GS :

[Sample Program]

[Print Results]

See Sample Program and Print Results for GS : on Page 57.

GS H n

[Function] Selecting of Printing Position of HRI Code

[Code] <1D>H<48>H<n>

[Range] {0 =< n =< 3} Data is described in Hex code.

[Outline] Selecting printing position of HRI code in printing bar codes.

- "n" means the followings.

| n (Hex) | Printing Position |
|---------|-----------------------------------|
| 0 | No printing |
| 1 | Above the bar code |
| 2 | Below the bar code |
| 3 | Both above and below the bar code |

The HRI code refers to the bar code-turned characters so that you can read them.

[Caution] The HRI code is printed in the font selected with GS f. Specify before the GS k command.

[Default] • The initial value of n is "0".

[See Also] GS f

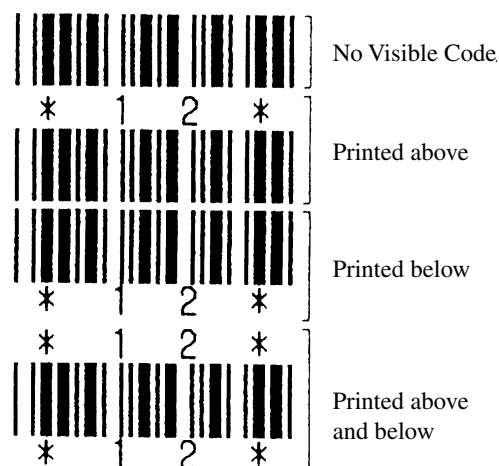
[Sample Program]

```

LPRINT CHR$ (&H1B) + "3" + CHR$ (5);
LPRINT CHR$ (&H1D) + "h" + CHR$ (50);
LPRINT CHR$ (&H1D) + "H" + CHR$ (0);
GOSUB BC
LPRINT CHR$ (&H1D) + "H" + CHR$ (1);
GOSUB BC
LPRINT CHR$ (&H1D) + "H" + CHR$ (2);
GOSUB BC
LPRINT CHR$ (&H1D) + "H" + CHR$ (3);
GOSUB BC
END
BC:
LPRINT CHR$ (&H1D) + "k";
LPRINT CHR$ (4);
LPRINT "12" + CHR$ (0);
LPRINT CHR$ (&HA);
RETURN

```

[Print Results]



GS f n

[Function] Selecting the font of HRI code

[Code] <1D>H<66>H<n>

[Range] n = 0, 1

[Outline] Selecting the font of HRI code in printing bar code.
The type of font can be printed by selecting n is as follows.
The HRI code refers to the bar code-turned characters so that you can read them.

| n | Font |
|---|--------|
| 0 | Font A |
| 1 | Font B |

[Caution] The HRI code is printed at the position specified with GS h on page 63.

[Default] The initial value of n is "0".

[See Also] GS H

[Sample Program]

```
LPRINT CHR$ (&H1D) + "h" + CHR$ (50);
LPRINT CHR$ (&H1D) + "H" + CHR$ (2);
LPRINT CHR$ (&H1D) + "f" + CHR$ (0);
GOSUB BC
LPRINT CHR$ (&H1D) + "f" + CHR$ (1);
GOSUB BC
END
BC:
LPRINT CHR$ (&H1D) + "k";
LPRINT CHR$ (4);
LPRINT "123" + CHR$ (0);
LPRINT CHR$ (&HA);
RETURN
```

[Print Results]



GS h n

[Function] Selecting the height of the Bar Code

[Code] <1D>H<68>H<n>

[Range] { 1 =< n =< FF } Data is described in Hex code.

[Outline] Selecting bar code height.
n denotes the number of dots in the vertical direction.

[Default] • The initial value of n is "162".

[Sample Program]

[Print Results]

See Sample Program and Print Results for GS w on page 68.

GS k n [d] k NUL

[Function] Printing the Bar Code

[Code] <1D>H<6B>H<n> [<d>] k <00>H

[Range] { 0 =< n =< 7 } Data are described in Hex code.

[Outline] Specifying a type of bar code and printing bar codes.

- The beginning of line is considered as the next printing start position.
- Depending on the value of n, the following bar code can be selected.

d indicates a character code to be printed and k indicates the number of character to be printed.

| n (Hex) | Bar Code System | Maximum Columns |
|---------|-----------------|-----------------|
| 0 | UPC-A | --- |
| 1 | UPC-E | --- |
| 2 | JAN13 (EAN) | --- |
| 3 | JAN 8 (EAN) | --- |
| 4 | CODE 39 | 13 |
| 5 | ITF | 22 |
| 6 | CODABAR (NW-7) | 17 |
| 7 | CODE 128 | 15 |

- [Caution]**
- When data being held in the print buffer, this command is ignored.
 - Regardless of the specified feed pitch, this command feeds the paper to be required to print a bar code.
 - If the character code d cannot be printed in the respective bar code system, the bar code so far will be printed, processing the subsequent data as normal data.
 - When a bar code whose number of characters to be printed is fixed has been selected, the number of characters k have to be always made equal to the number of characters to be printed. (The bar code is not printed when not matching.)
 - When the horizontal direction exceeds one line length, the excess part is not printed.

- [Default]**
- The initial value is not specified.

[Description of Bar Codes] <For print examples, see Page 67. >

- UPC-A This bar code, consisting of numerals only, has a fixed length of 12 column; a 11-columns number entered from the host or application software plus a check column(12th column) automatically calculated inside the printer. If the 12th-column numeral is sent from the host, the entire bar code will be printed as it is.
- UPC-E This bar code, consisting of numerals only, has a fixed length of 8 column; the first number system character is "0" stationary. A 12-column numeral entered from the host or application software is compressed to 8 columns with a check column and printed. The 12th-column check column is automatically calculated inside the printer and sent from the host, the entire bar code will be printed, compressed to 8 columns.
- JAN13(EAN) This bar code, consisting of numerals only, has a fixed length of 13 column; a 12-column number entered from the host or application software plus a check column(13th column) automatically calculated inside the printer. If the 13th-column numeral is sent from the host, the entire bar code will be printed as it is.
- JAN8(EAN) This bar code, consisting of numerals only, has a fixed length of 8 column; a 7-column number entered from the host or application software plus a check column(8th column) automatically calculated inside the printer. If the 8th-column numeral is sent from the host, the entire bar code will be printed as it is.
- CODE39 This bar code, consisting of uppercase alphabets and numerals, has a variable length of column. A start/stop code "*" is automatically added by the printer. Available characters include a space and "\$, %, *, +, -, ·, /, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9," and uppercase alphabets.
- ITF This bar code, consisting of numerals only, has a variable length of even column. If an odd-column code is transferred, nothing will be printed.
- CODABAR (NW-7) This bar code, consisting of alpha numerals, has a variable length of column. Available characters include "0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, D, D, \$, +, -, ·, /, :." A start/stop code is required; any one of A, B, C, and D is used.
- CODE128
 - This bar code consists of all of 128 ASCII code characters and has a variable length of column. This printer supports the code subsets A, B, and C. By prefixing a transfer code with any one character of A, B, and C, you can select the code subset to start from. If not prefixed with A, B, or C, the code subset B will be selected.
 - The code subset A is the bar code consisting of standard uppercase alphabets, numerals, symbols, and special codes.
 - The code subset B is the bar code consisting of standard uppercase/lowercase alphabets, numerals, symbols, control codes, and special codes.
 - The code subset C is the bar code consisting of special characters and 100 kinds of numbers ranging from 00 to 99.
 - The check column automatically calculated inside the printer is added to the end of the entered column to be printed.

- Processing of the special characters

The characters above the ASCII code number 96 are considered special characters. The following lists the converted characters for entering these characters.

| ASCII Code | Converted Character | Subset Code | Subset Code B | Subset Code C |
|------------|---------------------|-------------|---------------|---------------|
| 96 | 80h | FNC 3 | FNC 3 | -N/A- |
| 97 | 81h | FNC 2 | FNC 2 | -N/A- |
| 98 | 82h | SHIFT | SHIFT | -N/A- |
| 99 | 83h | CODE C | CODE C | -N/A- |
| 100 | 84h | CODE B | FNC 4 | CODE B |
| 101 | 85h | FNC 4 | CODE A | CODE A |
| 102 | 86h | FNC 1 | FNC 1 | FNC 1 |

The following exemplifies a selection of the code subset as a method to utilize the special characters.

<Selection of Code Subset>

- Initial selection: Enter any one character of A, B, and C.
- Conversion on the way: Enter any one character of 82h through 85h

Example) When initially testing with the code subset B, and then, printing the bar code, "123," with the code subset A

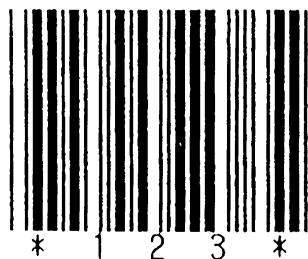
• Input code : B TEST <85> 123

• Bar code data : <CODE B>TEST<CODE A>123

[Sample Program]

```
LPRINT CHR$ (&H1D) + "H" + CHR$ (2);
LPRINT CHR$ (&H1D) + "k";
LPRINT CHR$ (4);
LPRINT "123" + CHR$ (0);
```







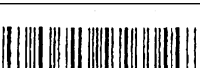

[Print Results]



When the data "123" is printed with the code 39

[Description of Bar Codes]

UPC-A, UPC-E, JAN-13 (EAN), JAN-8 (EAN), CODE39, ITF, CODABAR, CODE128

| Type | Print Sample | Outline of Symbol | Max. column |
|-------------------|--|--|-------------|
| UPC-A |  1 2 3 4 5 6 7 8 9 0 1 2 | 12-column fixed-length bar code consisting of numerals only | — |
| UPC-E |  1 2 3 6 4 3 | 8-column fixed-length bar code consisting of numerals only. Abbreviated version of UPC-A | — |
| JAN-13 |  1 2 3 4 5 6 7 8 9 0 1 2 3 | 13-column fixed-length bar code consisting of numerals only | — |
| JAN-8 |  1 2 3 4 5 6 7 0 | 8-column fixed-length bar code consisting of numerals only | — |
| CODE39 |  1 2 3 4 5 | Variable-length bar code consisting of alphabets and numerals. The start/stop code "*" is automatically added. | 13 |
| ITF |  1 2 3 4 5 6 7 8 9 0 | Even-column variable-length bar code consisting of numerals only | 22 |
| CODABAR (NW-7) |  a 1 2 3 4 5 6 a | Variable-length bar code consisting of alpha numerals. Any one of A, B, C, and D is required as the start/stop code. | 17 |
| CODE128 |  A B C D 1 2 3 4 5 | Variable-length bar code consisting of all 128 ASCII code characters. | 15 |

Printing is done depending on bar code specification type, number of print column, bar code height, width (Magnification), visible code presence, and bar code data specification.

GS w n

[Function] Selecting the horizontal size (Scale factor) of the Bar Code

[Code] <1D>H <77>H<n>

[Range] { 2 =< n =< 4 } Data is described in Hex code.

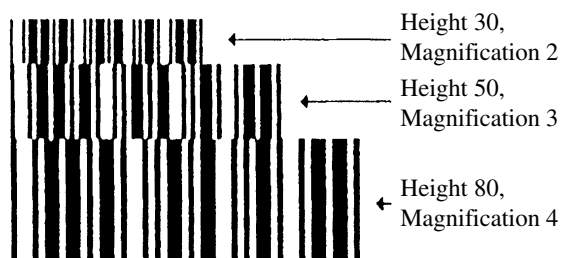
[Outline] Selecting bar code width.
n denotes the number of dots in fine element width.

[Default] • The initial value of this width is "3".

[Sample Program]

```
LPRINT CHR$ (&H1D) + "h" + CHR$ (30);
LPRINT CHR$ (&H1D) + "w" + CHR$ (2);
GOSUB BC
LPRINT CHR$ (&H1D) + "h" + CHR$ (50);
LPRINT CHR$ (&H1D) + "w" + CHR$ (3);
GOSUB BC
LPRINT CHR$ (&H1D) + "h" + CHR$ (80);
LPRINT CHR$ (&H1D) + "w" + CHR$ (4);
GOSUB BC
END
BC:
LPRINT CHR$ (&H1D) + "k";
LPRINT CHR$ (4);
LPRINT "12" + CHR$ (0);
RETURN
```

[Print Results]



ESC = n**[Function]** Data Input Control**[Code]** <1B>H<3D>H<n>**[Range]** {0 =< n =< FF} Data is described in Hex code.**[Outline]** Selecting equipment in which data input from the host is effective.

- Each bit of n indicates as follows:

| Bit | Equipment | Value | |
|-----|-------------|---------|-------|
| | | 0 | 1 |
| 0 | Printer | Invalid | Valid |
| 1 | Not defined | | |
| 2 | Not defined | | |
| 3 | Not defined | | |
| 4 | Not defined | | |
| 5 | Not defined | | |
| 6 | Not defined | | |
| 7 | Not defined | | |

- When the printer has not been selected, this printer abandons all the received data until it is selected by this command.

- [Caution]**
- Even when the printer has not been selected, it can become BUSY state through printer operation.
 - When the printer is deselected, this printer discards all the data until it is selected with this command.

- [Default]**
- The initial value of n is "1".

[Sample Program]

```

LPRINT "AAAAA";
LPRINT CHR$ (&H1B) + "=" + CHR$ (0);
LPRINT "aaaaa" + CHR$ (&HA);
LPRINT CHR$ (&H1B) + "=" + CHR$ (1);
LPRINT "AAAAA" + CHR$ (&HA);

```

[Print Results]

```

A A A A A A A A A
    ↑
  a a a a a is not printed

```


ESC @

[Function] Initializing the Printer

[Code] <1B>H<40>H

[Range] Clears data stored in the print buffer and brings various settings to the initial state (Default state).

[Caution]

- Data inside the internal input buffer are not cleared.
- Dip switches setting are red once again.

[Sample Program]

```
LPRINT CHR$ (&H1B) + " !" + CHR$ (&H30) ;  
LPRINT CHR$ (&H1B) + "V" + CHR$ (1);  
LPRINT "AAA" + CHR$ (&HA);  
LPRINT CHR$ (&H1B) + "@";  
LPRINT "AAA" + CHR$ (&HA);
```

[Print Results]

! V A
A A A

DC2 A n

[Function] Selecting the Print drive system

[Code] <12>H<41>H<n>

[Range] {0 =< n =< FF}

[Outline] Selecting the Fixed division system or the Variable division system.

- "n" is valid only for the lowest bit (n0).

| n0 | Print Drive System |
|----|---------------------------------|
| 0 | Fixed division number system |
| 1 | Variable division number system |

[Default] The initial value of n is specified by Jumper (J5).

10. CHARACTER CODE TABLE

10.1 International

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---|-----|-----|----|---|---|---|---|----|---|----------------|---|---|---|---|---|----|
| 0 | NUL | | SP | 0 | @ | P | ‘ | p | Ç | E | à | ☐ | ⌋ | ⌊ | ∞ | ≡ |
| 1 | | ION | ! | 1 | A | Q | a | q | ü | æ | í | ☐ | ⌋ | ⌊ | β | ± |
| 2 | | | ” | 2 | B | R | b | r | é | Æ | ó | ☐ | ⌋ | ⌊ | Γ | ≈ |
| 3 | | XOF | # | 3 | C | S | c | s | á | ô | ú | ⌋ | ⌊ | ⌊ | π | ≡ |
| 4 | | | \$ | 4 | D | T | d | t | ä | ö | ñ | ⌋ | ⌊ | ⌊ | Σ | ⌋ |
| 5 | | | % | 5 | E | U | e | u | à | ò | Ñ | ⌋ | ⌊ | ⌊ | σ | ⌋ |
| 6 | | | & | 6 | F | V | f | v | á | û | ä | ⌋ | ⌊ | ⌊ | μ | ÷ |
| 7 | | | ' | 7 | G | W | g | w | ç | ù | ö | ⌋ | ⌊ | ⌊ | τ | ≈ |
| 8 | | | (| 8 | H | X | h | x | é | ÿ | í | ⌋ | ⌊ | ⌊ | Φ | ○ |
| 9 | HT | |) | 9 | I | Y | i | y | ë | 0 | - | ⌋ | ⌊ | ⌊ | θ | . |
| A | LF | | * | : | J | Z | j | z | è | ü | - | ⌋ | ⌊ | ⌊ | Ω | . |
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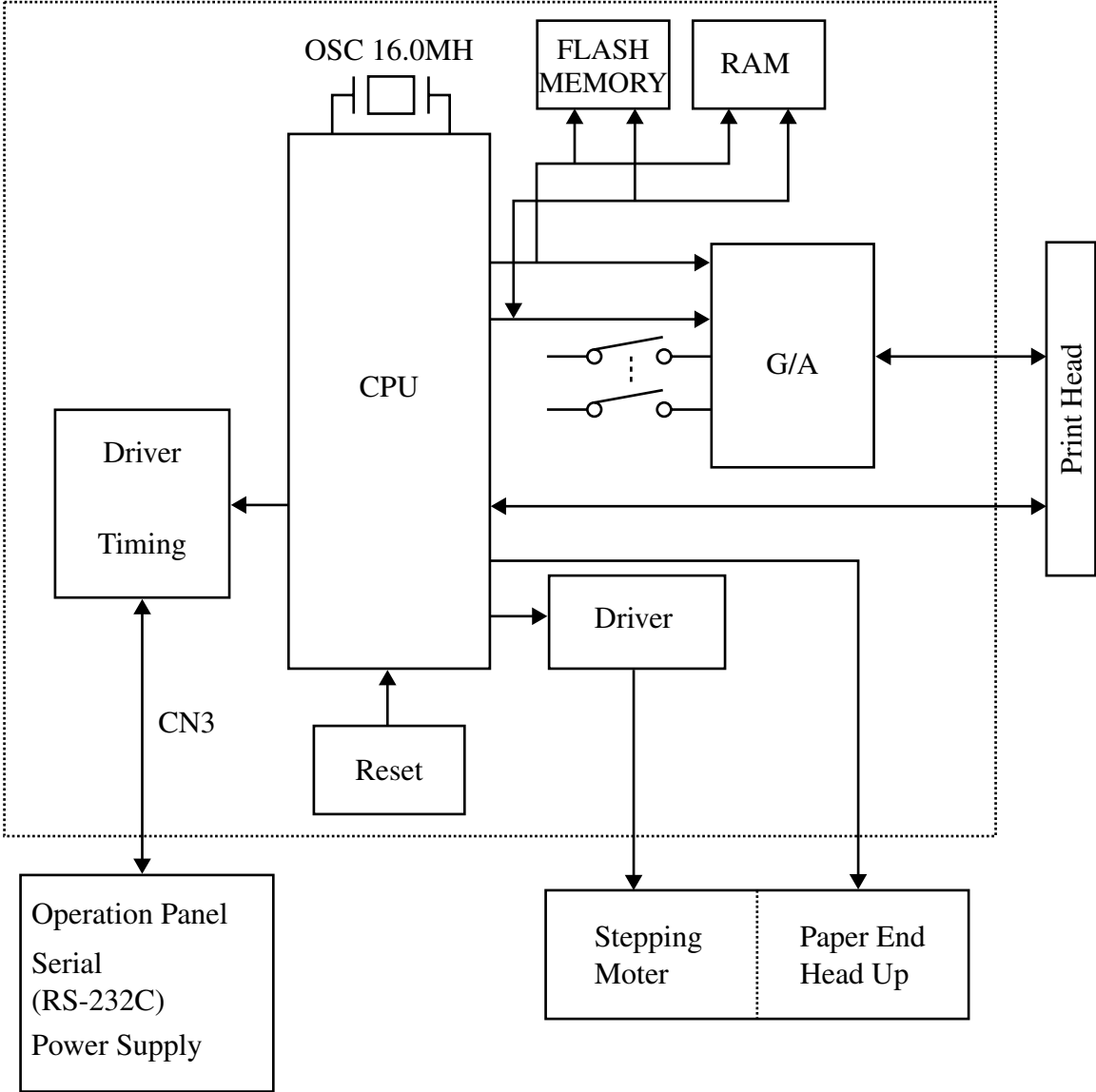
10.2 Japanese

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10.3 International Character Set

| | COUNTRY | 23 | 24 | 40 | 5B | 5C | 5D | 5E | 60 | 7B | 7C | 7D | 7E |
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| 1 | France | # | \$ | a | · | ç | § | ^ | ` | é | ù | è | ¨ |
| 2 | Germany | # | \$ | § | À | Ö | Ü | ^ | ` | a | o | u | ß |
| 3 | U.K. | £ | \$ | @ | [| \ |] | ^ | ` | (| |) | ~ |
| 4 | Denmark I | # | \$ | @ | Æ | Ø | À | ^ | ` | æ | ø | à | ~ |
| 5 | Sweden | # | ¤ | é | À | Ö | À | Ü | é | a | o | a | u |
| 6 | Italy | # | \$ | @ | · | \ | e | ^ | ù | a | ò | è | ì |
| 7 | Spain | ₧ | \$ | @ | í | ñ | ¿ | ^ | ` | ¨ | ñ |) | ~ |
| 8 | Japan | # | \$ | @ | [| Y |] | ^ | ` | (| |) | ~ |
| 9 | Norway | # | ¤ | é | Æ | Ø | À | Ü | é | æ | ø | a | u |
| 10 | Denmark II | # | \$ | é | Æ | Ø | À | Ü | é | æ | ø | a | u |

APPENDIX 1. BLOCK DIAGRAM



APPENDIX 2. OUTER DIMENSION

